ASSESSMENT OF IMPACT OF GENETICALLY ENGINEERED (GE) MUSTARD (*Brassica juncea* L.) ON HONEY BEES


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Technology used to control pollination in GE mustard to produce hybrid seed (DMH-11)

- One of the public concern was whether planting of GE mustard would harm honey bee population or affect honey.

- Based on the biosafety data generated over a period of 13 years, regulators prepared an Assessment of Food and Environment Safety (AFES) document and invited public comments by placing it in the MoEF&CC website.

- Three possible risk scenarios were considered to assess effect of GE mustard on honey bees.

Components of technology

<table>
<thead>
<tr>
<th>Genes</th>
<th>Promoters</th>
<th>Purpose</th>
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<tbody>
<tr>
<td>barnase</td>
<td>(Tapetum specific)</td>
<td>To make pollen unviable by degrading RNA</td>
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<tr>
<td>barstar</td>
<td>(Tapetum specific)</td>
<td>To inactivate Barnase by binding selectively</td>
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<tr>
<td>bar</td>
<td>(Constitutive)</td>
<td>To select male sterile female parent</td>
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RISK Hypothesis 1:
The expressed transgenes will:
- Effect floral morphology
- Effect nectarine development
- Effect the frequency of honey bee visits

Risk assessment on effect of transgenes on floral morphology is found to be negligible/nil.
RISK Hypothesis 2: “Presence of transgene encoded proteins in pollen will make honey unsuitable for human consumption”

Estimated Daily Intake (EDI)
5.62e-10 Barnase protein/kg bw/d (mean user) & 1.40e-9 Barnase protein/kg bw/d (90% user)

**Rodent acute oral toxicity study:**
* No adverse effects observed at highest dose tested = 1000 mg Barnase protein/kg body weight

**Margin of Exposure (MOE)**
The MOE for consumers (90%) of RAW honey is at least 1000/1.40e-9 = 7.1 X 10^11!
as compared to MOE of Cry protein of 10^8

Higher the MOE, the lower the health concern; MOE >10^3 = low concern

- Barnase expression is specific to tapetum and transient during pollen production
- >20 years of history of safe use of Barnase in rapeseed (*B. napus*), a sister crop of Indian oilseed mustard

**Transgene expression in pollen and subsequent presence in honey**

| MOE of transgene in honey is <10^3 | Highly unlikely |
| Honey not suitable for human consumption | Highly unlikely |

Risk assessment on potential toxicity of honey to human is found to be negligible/nil.
RISK Hypothesis 3:

Nectar/Pollen containing transgene toxic to honey bees

Risk assessment on toxic effect of transgenes on honey bee population was found to be negligible/nil.
Conclusion

❖ The risk due to the expression of transgenes in GE mustard DMH-11 on honey bee population has been assessed as Negligible

❖ The risk due to the expression of transgene on honey has been assessed as Negligible

❖ Based on risk assessment it was concluded that GE mustard DMH-11 will not pose any risk to honey population as well as honey.